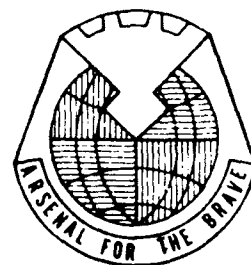


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FINAL REPORT of the AMC COMMITTEE-ARMAMENT

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EXECUTIVE SUMMARY

VOLUME 1 of 4 VOLUMES
December 1974

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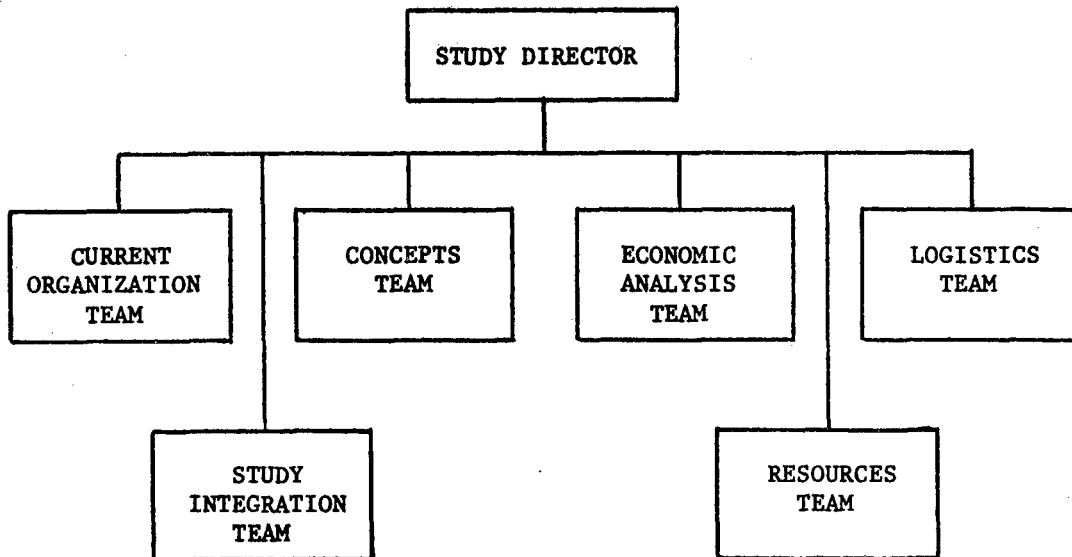
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DISCLAIMER

This report is the product of the Army Materiel Command Committee-Armament, an ad hoc committee formed by the Commander, US Army Materiel Command. It responds to a Department of the Army requirement to study the recommendation of the Army Materiel Acquisition Review Committee (AMARC) regarding establishment of an Armament Development Center. It presents alternative concepts, not detailed plans. It is advisory in nature and reflects neither official policy nor approved plans of the Department of the Army. The Secretary of the Army has directed that it be released to interested Members of Congress for their review and comment.

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VOLUME 1

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The Executive Summary is in two parts; Part I contains the findings and recommended concept; Part II is a summary of the study that supports the findings and concept.

INTRODUCTION.

This volume contains a highly summarized version of the concept plan and supporting study for establishment of an Armament Development Center (ADC). The study has been prepared in response to one of the principal AMARC ^{1/} recommendations--create a new Armament Development Center at a single location, through an evolutionary process, by consolidating selected RD&E elements of Frankford, Picatinny, Rock Island, Watervliet and Edgewood Arsenals, the RD&E Directorate of US ARMCOM and the Ballistics Research Laboratories.

PART I

FINDINGS AND RECOMMENDED CONCEPT

1. Major Findings: After study of the organization and operation of the current armament community, other development organizations, and the AMARC report and after developing, analyzing, and costing numerous alternative concepts with the aid of in-house experts and consultants, the committee finds:

- a. The armament acquisition process is in need of major improvement and the need is compelling.
- b. A consolidation of fragmented activities and reorganization into systems laboratories will assist in providing an opportunity for improvement and a climate for change.
- c. Significant economies can be achieved with reorganization and consolidation.
- d. The armament development activities will be in a good position for the long term if any one of the preferred alternatives is adopted.
- e. None of the alternatives is without disadvantages.

^{1/} AMARC, the Army Materiel Acquisition Review Committee, was formed at the direction of The Secretary of the Army in December 1973, to study the Army's materiel acquisition process. The AMARC report was submitted 1 April 1974.

f. All alternatives are significantly better than the status quo.

g. The decision to implement should be made with recognition of:

(1) The risks and costs, as well as the advantages, attendant to the selected alternative.

(2) The need for skillful and flexible implementation to retain the people--professional, subprofessional, support, and administrative personnel--who comprise the expertise in the current community, thereby maintaining continuity in important programs and the capability to produce armaments.

(3) The need at the start for strong support from top levels in DA and DoD, and the Congress, and for their commitment to continued support throughout the transition.

2. Recommended Concept. The recommended concept is to establish an Armament Development Center (ADC) with responsibility for research, development, and the transition of newly developed armament materiel into quantity production. The ADC will be built upon a core of four laboratories, three systems development laboratories--large caliber weapons, small caliber weapons, ^{1/} and chemical materiel--supported by a fourth laboratory for ballistics research (Figure 1-1). The center will incorporate those on-going activities clearly relevant to the armament acquisition mission now located at Frankford, Rock Island, Picatinny, and Watervliet Arsenals, the Ballistics Research Laboratories, and Edgewood Arsenal. The organizational and operational concept follows from the objectives established for the ADC, with emphasis on those related to systems orientation, clear assignment of responsibility, intensive management of concepts and projects, close coupling between technology and development, and a strong bond with the user.

3. Preferred Alternatives. Eleven alternatives were generated by varying the population, degree of consolidation, ^{2/} and location of organizational elements; these have been analyzed and evaluated with respect to operational considerations, personnel, costs, and community impact. The committee weighed the advantages and disadvantages of each alternative and finds three that stand above the

^{1/} In the ADC Concept, small caliber includes weapon systems below 40mm; large caliber, 40mm and above.

^{2/} Although AMARC recommended a single-site ADC, two and three-site alternatives were also studied.

ADC ORGANIZATIONAL CONCEPT

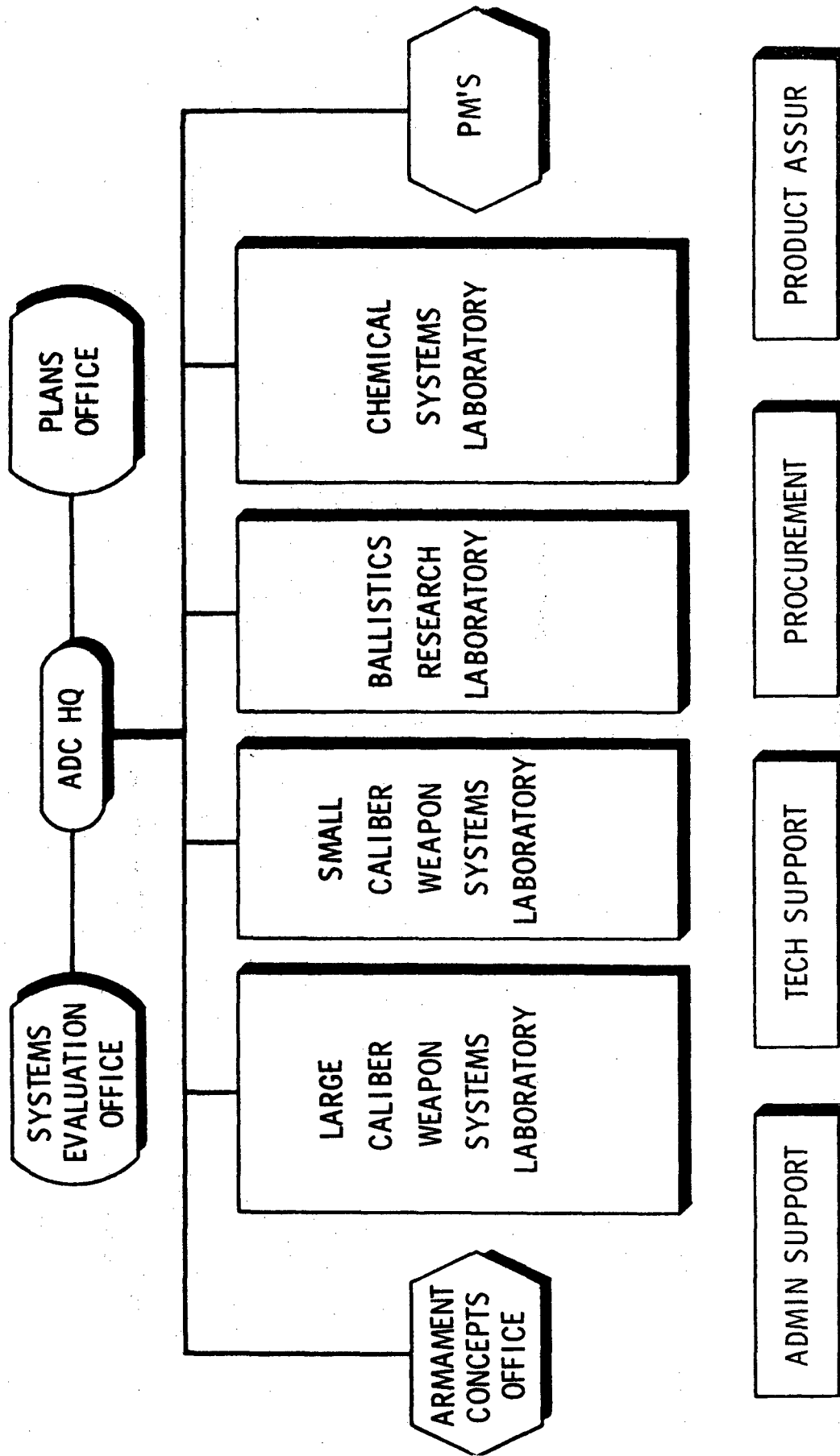


Figure 1-1

rest; they are shown in order of preference in the table (Figure 1-2). Evaluation of these alternatives is summarized in Figure 1-3. For comparison, the status quo (Alternative 1) is also shown.

4. Rationale for Order of Preference. Alternative 3, with its great long term benefits was ranked third because of the high degree of dislocation of the large caliber ammunition personnel with attendant increased potential for reduced capability, especially in support of production; the sharper adverse impact on one community (Dover, NJ); and the higher initial investment required. The initial investment of \$138 million is not, by itself, considered a major discriminator since present value costs are close to those of the first choice alternative. Alternative 5 was preferred to Alternative 3 because it avoids the dislocations cited above, yet provides an excellent opportunity for a partial fresh start. Alternative 5A was preferred to Alternative 5 because the ADC headquarters would be collocated with the two principal weapon systems laboratories which constitute 70 percent of the ADC population, it enjoys relative ease of implementation, and because top management is located where it can directly influence generation of a fresh start.

5. Impact Upon ARMCOM. A separate substudy examined the impact that the formation of an ADC would have on the remainder of ARMCOM. An Armament Logistics Command (ALC) complementary to the ADC was explored in concept form. The ALC would be responsible for the materiel management functions of supply, maintenance, production, and related procurement activities. The ADC and ALC would each support the other. The substudy determined that a separate Logistics Command is feasible, would not grow in population or budget from the status quo, and varies only slightly from one ADC alternative to another. Therefore, it should not influence the choice of an alternative for the ADC.

6. Implementation. Before the ADC assumes responsibility for on-going or new programs, key leaders must be selected and hired; detailed transition plans must be prepared; and responsibilities, authority, and resources assigned the implementers. The plan must be capable of being modified during the execution phase to accommodate to unforeseen events or to those anticipated in all aspects except timing. The ADC must be ready to accelerate the rate of implementation; movement will be determined by the availability of personnel and facilities and by the need to maintain continuity of programs. For the planning period it is proposed to establish a provisional headquarters.

a. Provisional Headquarters. The provisional ADC will comprise a command and management element, a planning staff including experts in civilian personnel, construction, programming, transportation, and operations at each of the affected facilities, plus an administrative

PREFERRED ALTERNATIVES

<u>RANK</u>	<u>ALTERNATIVE</u>	<u>SITE(S)</u>	<u>HQ</u>	<u>LABORATORY AT SITE</u>
<u>First</u>	5A, Two-Site	Picatinny	HQ	Large Caliber Systems Small Caliber Systems
		Aberdeen		Ballistics Research Chemical Systems
<u>Second</u>	5, Two-Site	Picatinny		Large Caliber Systems
		Aberdeen	HQ	Small Caliber Systems Ballistics Research Chemical Systems
<u>Third</u>	3, One-Site	Aberdeen	HQ	Large Caliber Systems Small Caliber Systems Ballistics Research Chemical Systems

Figure 1-2

PREFERRED ALTERNATIVES

RANKING			FIRST	SECOND	THIRD	STATUS QUO
ALTERNATIVE _____ LOCATION _____ POPULATION _____			5A APG-PA 7,817	5 APG-PA 8,083	3 APG 6,386 ^{a/}	1 RIA-FA-PA-APG-WA 10,542
OPERATIONAL CONSIDERATIONS	INTERNAL INTERFACES		GOOD +	GOOD -	EXCELLENT +	POOR
	WORKFORCE FLEXIBILITY		EXCELLENT -	GOOD	EXCELLENT +	POOR
	EXTERNAL INTERFACES		EXCELLENT -	GOOD +	EXCELLENT +	POOR
	"FRESH START"		GOOD -	GOOD +	EXCELLENT	POOR
	STEADY STATE DATE (FY)		1980	1980	1981	1976
PERSONNEL ASPECTS	TRANSFERS (% OF ADC)	IN PLACE	5,571 (71%)	4,977 (62%)	2,383 (37%)	100%
		RELOCATE	1,374 (18%)	2,207 (27%)	3,105 (49%)	0%
	RECRUITMENT REQUIRED (% OF ADC)		872 (11%)	899 (11%)	898 (14%)	0%
	SEPARATION (RIF) EXPECTED		1,349	1,259	1,895	0
COSTS	ONE TIME INVESTMENT (MILLIONS)		\$ 76	\$ 79	\$138	\$ 0
	ANNUAL STEADY STATE (MILLIONS)		\$287	\$298	\$281	\$347
	STEADY STATE SAVINGS (MILLIONS)		\$ 60	\$ 49	\$ 66 ^{b/}	\$ 0
	INVESTMENT RECOVERY PERIOD (YEARS)		4.3	4.6	5.0	-
	PRESENT VALUE 15 YEAR OPERATIONS (MILLIONS)		\$2,501	\$2,560	\$2,505	\$2,769
COMMUNITY ECONOMIC IMPACT			MODERATE	MODERATE	MODERATE	NONE

^{a/} Population of Alternative 3 (6386) would be approximately 7500 if based on the "Consolidated" ADC population model, as are the populations of Alternatives 5A and 5, rather than the "Minimum" model. The difference (6386 versus 7500) has little economic significance. The two basic single-site population models ("Consolidated" and "Minimum") were developed by detailed analysis of the manning required to accomplish the ADC mission and functions. Approximately 7500 personnel were considered adequate with a slight increase in out-of-house development effort; and approximately 6400 personnel were considered to be the minimum required in-house workforce, with a correspondingly larger increase in out-of-house effort. Two-site ADC configurations of each model require slightly more personnel (7817 and 8083 for Alternatives 5A and 5, versus 7500). Due to higher personnel turbulence, it is expected that the actual ADC population of a single-site ADC would approach the "Minimum" model, while multi-site configurations would be closer to the "Consolidated" model.

^{b/} Savings (\$66 million) would be approximately the same for the higher population (7500) model because with the increase in ADC population less work would be done by contract.

Figure 1-3

element. Priority will be given to keeping informed the employees within the armament community who comprise its expertise, and to searching for and selecting laboratory directors and other top management personnel. Provisional status should be guaranteed until all major tasks are completed.

b. ADC Activation and Transition. At activation the ADC would manage the armament RD&E program as does a project manager. Until transfer, the work would be accomplished where it is being done now, at the arsenals, at BRL and on contract. As a control measure, a technical "phase-down" team will be established at each losing activity to insure continuity of programs and to warn of potential loss of expertise and capability.

c. Time to "Steady State." It is estimated that four years will be required from date of activation of the ADC until all personnel and programs are transferred, new talent recruited, and all essential construction and renovation of facilities completed.

d. Selection of Commander. The commanders selected for the ADC and ALC should be officers who have the full confidence of their superiors in AMC and DA and, therefore, can be delegated the needed authority to accomplish this large, complex, and important task.

e. Special Authorities. Successful creation of an ADC will require waivers to existing regulations and policies. These must be granted, for example, to permit the ADC to have its own Civilian Personnel Office or to have assigned the number and quality of military officers needed to meet the ADC's new objectives.

f. Milestone Schedule. Figure 1-4 is the milestone schedule of the ADC covering the period from announcement of the decision to implement through the transition period.

ADC MILESTONE SCHEDULE a/

	<u>MILESTONE</u>	<u>DATE</u>
D-Day	Announce ADC Concept and decision to implement. Establish Provisional ADC Headquarters with top management and planning staff to include civilian personnel, movement, technical, and other supporting specialist administrative elements.	1 Jul 1975
D+1 mo	Establish task forces to accomplish detailed planning for activation of ADC and building up its capabilities. Initiate talent search for key leaders. Plan for new construction and renovation programs. Establish Civilian Personnel Office and nucleus of Procurement Office. Continuously coordinate with Logistics Command.	1 Aug 1975
D+4 mo	Submit MCA budget.	1 Nov 1975
D+6 mo	Select laboratory directors and start recruiting second level management. Establish teams at losing and gaining sites to assist in relocation of individuals, programs, and equipment.	1 Jan 1976
A-Day (D+9 mo)	Activate ADC. Assume budget authority and full responsibility for RDE programs. Assume control of development PMs. Start movement of fire control, small arms ammunition, mechanical time fuzes, shell metal parts, and supporting technologies from Frankford. Start movement of relatively new developmental programs from Rodman and Benet Laboratories.	1 Apr 1976
A+12 mo	Complete movement from Frankford and new programs from Benet and Rodman.	1 Apr 1977
A+18 mo	Establish Armament Institute.	1 Oct 1977
A+24 mo	Complete all systems management movement to ADC. Start technology program move from Benet.	1 Apr 1978
A+48 mo	Consolidate all activities at ADC. Initial MCA complete. ADC reaches "steady state" condition.	1 Apr 1980

a/ This schedule is based on Alternatives 5A and 5, modification will be necessary if Alternative 3 is selected.

Figure 1-4

PART II - STUDY SUMMARY

The remainder of this volume will be devoted to a summarized version of the major steps leading to the findings and organizational concept presented in PART I. All steps taken are listed below in sequence, but the overall process was iterative.

- o The current armament community was analyzed to provide a base line and to identify strengths and weaknesses.

- o The objectives or goals of the ADC were established and the mission and functions derived.

- o An ideal or "reference" organization was developed. A concept of operation, initially in outline form, was prepared to assist in this effort; the concept was refined during the iterative process.

- o The reference organization was populated and the need for unique facilities established.

- o An ALC substudy was undertaken to complement the ADC effort.

- o Potential sites were visited and studied.

- o Feasible alternatives that considered single and multi-sited ADCs were generated, analyzed and compared.

- o Preferred alternatives were selected and ranked on the basis of personnel, operations, costs, and community economic impact.

- o An implementation plan was devised.

SECTION A: Current Armament Community.

1. Armament Community. The current armament community, as defined in this ADC study, comprises the US Army Armament Command (ARMCOM) plus the Ballistic Research Laboratories (BRL). An indicator of the number, type, and geographic dispersion of the community's agencies is shown in Figure 1-5.

2. Mission. ARMCOM is responsible for "integrated commodity management" of armament systems and materiel. ARMCOM's 1520 major items now in the Army inventory include: 160 weapons, 890 munitions, and 470 tool and test items. ARMCOM's mission includes research and development, production base (arsenals and GOCO plants) and logistics support (includes supply, maintenance and related procurement).

3. Resources. The community's population totals approximately 26,000 civilian and military personnel; an additional 32,000 contract personnel operate the GOCO ammunition plants. Its budget totals \$2.68 billion. To give perspective to these quantities, the next largest AMC Commodity Command, ECOM, has a population of 11,500. ARMCOM's budget is one-fourth of AMC's. Figure 1-6, a tabular summary of the community's resources, permits a comparison in budget and population between development and logistics activities.

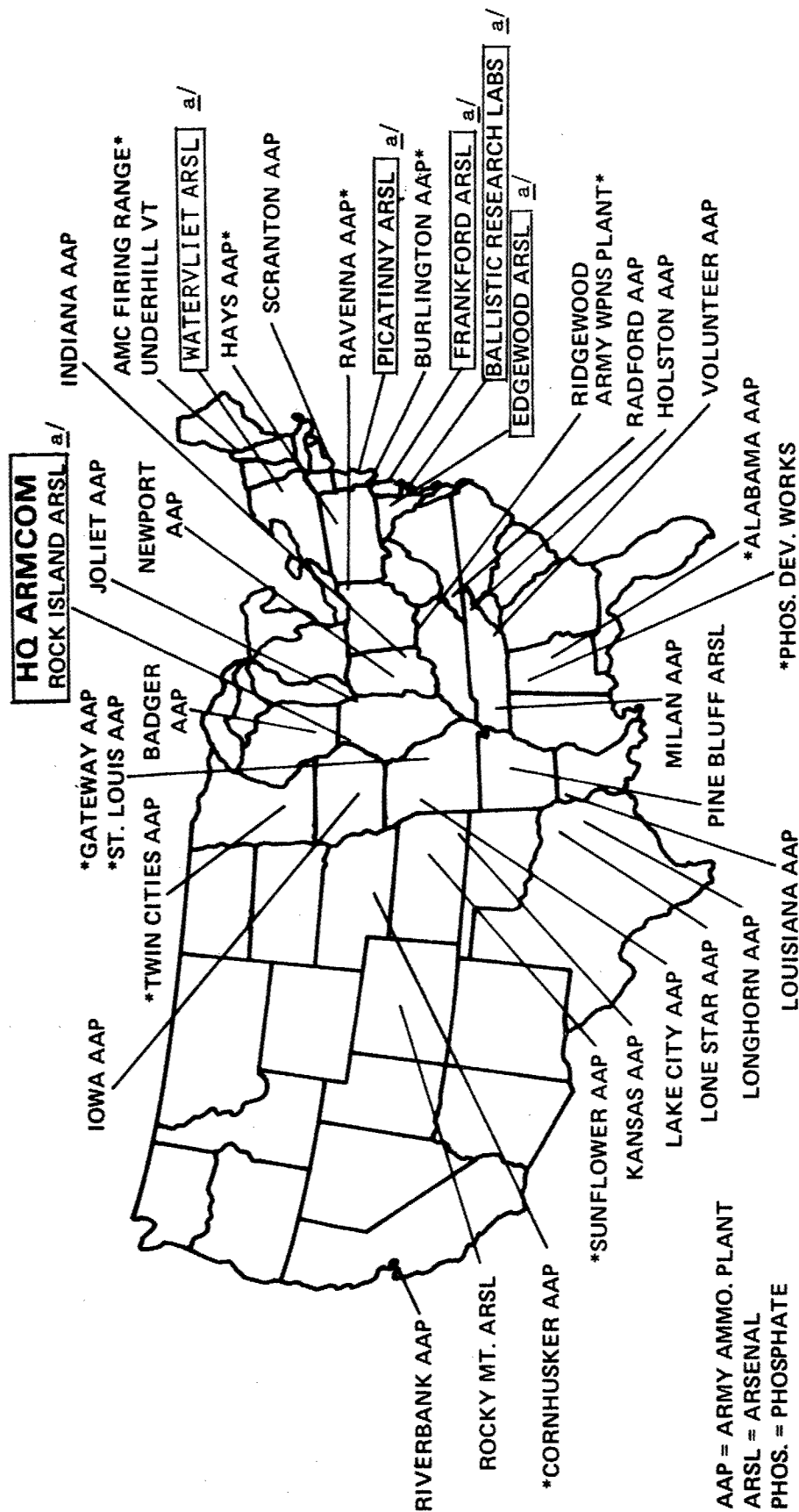
4. Strengths and Weaknesses. An overall assessment of the current armament development community indicates the following:

a. The major weaknesses are: (1) a high degree of operational complexity and rigidity resulting from mission fragmentation and organizational and geographical separation; (2) a strong supportive role to logistic activities at too high a cost to new developments; (3) a poor link to both the user and resource allocator; and (4) potential efficiencies not being realized. The organizational fragmentation of development activities is depicted in Figure 1-7.

b. The major strengths lie in the capability of groups of individuals who have produced and been responsive to urgent field and production requirements in spite of the inhibiting environment.

c. An additional strength has been the management action already taken by AMC and ARMCOM to address recognized problems, e.g., the MUCOM-WECOM merger and additional steps resulting from the TOAMAC and CONCISE studies.

CURRENT ARMAMENT COMMUNITY INSTALLATIONS AND ACTIVITIES



FY74 ARMAMENT COMMUNITY RESOURCES
BASE LINE DATA

RESOURCE	DEVELOPMENT	LOGISTICS	TOTAL ARMAMENT COMMUNITY
PERSONNEL	11,777 <u>a/</u>	13,938 <u>b/</u>	25,715 <u>c/</u>
HQ, ARMCOM	(731)	(3,260)	(3,991)
Rock Island Arsenal	(838)	(2,860)	(3,698)
Picatinny Arsenal	(4,871)	(677)	(5,548)
Watervliet Arsenal	(607)	(2,147)	(2,754)
Frankford Arsenal	(1,903)	(1,726)	(3,629)
Ballistic Rsch Lab	(892)		(892)
Edgewood Arsenal	(1,935)	(421)	(2,356)
Pine Bluff Arsenal		(1,125)	(1,125)
Rocky Mt Arsenal		(723)	(723)
Ammo Plants		(999)	(999)
FUNDS (Millions)	\$ 347	\$2,340	\$2,687
PEMA	(108)	(2,022)	(2,130)
RDTE	(210) <u>d/</u>		(210)
OMA	(29)	(196)	(225)
Other		(122)	(122)
FACILITIES			
Land (acres)			300,000
Buildings			19,000
Equipment (items)			568,000

a/ Includes 1,235 base operations support personnel not included in the ADC "status quo" population (10,542) due to the assumption that ADC installations support will be contractual.

b/ Does not include 32,000 contract personnel operating GOCO ammunition plants.

c/ Includes 1,197 military personnel.

d/ RDTE funds expended as follows: 65% in-house, 15% other government agencies, 20% industry.

Figure 1-6

(CURRENT LOCATION)

<u>LARGE CALIBER WEAPON SYSTEMS</u>	<u>LOCATION</u>	<u>SMALL CALIBER WEAPON SYSTEMS</u>	<u>LOCATION</u>
ARMOR/ARTILLERY WEAPONS		INFANTRY/ARMOR/AIR DEFENSE/	
RECOIL AND CARRIAGE	RIA	AVIATION WEAPONS	RIA
TUBE AND BREECH	WA	PISTOL/RIFLE	RIA
		MACHINE GUN	RIA
INFANTRY WEAPONS		AUTOMATIC CANNON	FA
MORTAR	WA		
RECOILLESS RIFLE	WA	AMMUNITION	FA
		FUZES	FA
AMMUNITION			PA
PROJECTILE/CASE	PA	FIRE CONTROL	FA
EXPLOSIVES/PROPELLANTS	PA		
METAL PARTS	FA		
CHEMICAL	EA		
		<u>CHEMICAL SYSTEMS</u>	
FUZES		CHEMICAL	EA
MECHANICAL TIME	FA	BIOLOGICAL DEFENSE	EA
IMPACT	PA		
PROXIMITY	HDL		
		<u>BALLISTICS RESEARCH</u>	
FIRE CONTROL	FA	BALLISTICS	BRL
			EA
MUNITIONS			FA
EXPLOSIVES	PA		PA
GRENADES	PA		WA
MINES	PA		
SMOKE	EA		
ILLUMINANTS	PA		
INCENDIARIES	EA		
		<u>VULNERABILITY</u>	
			BRL

KEY: BRL - BALLISTIC RESEARCH LABORATORIES PA - PICATINNY ARSENAL
 EA - EDGEWOOD ARSENAL RIA - ROCK ISLAND ARSENAL
 FA - FRANKFORD ARSENAL WA - WATERVLIET ARSENAL
 HDL - HARRY DIAMOND LABORATORIES

Figure 1-7

SECTION B. Organization and Operation of an Armament Development Center.

1. ADC Concept. The organizational concept has been designed to improve the armament acquisition process and to emphasize output. This will be achieved through:

- o Systems orientation
- o Clear assignment of responsibility
- o Intensive management of concepts and projects
- o Close bond between the technology base and development activities
- o Close bond with the user and resource allocator
- o Self-assessment and personnel development

2. ADC Mission. The mission identifies the principal areas of responsibility of the ADC and is sequenced to emphasize the "output" orientation of the center.

ADC MISSION

For assigned armament systems, components and related materiel:

- o Develop product improvements and new items and provide for transition into quantity production; make initial procurement.
- o Maintain a strong technology base--in government, industry, and universities--from which to evolve improved items and to prevent technological surprise.
- o Provide technical support to agencies with operational and logistics responsibilities for fielded items.

3. ADC Systems and Materiel. Representative systems and materiel are shown below:

Armament Systems and Materiel

Small Arms	New Concept Weapons
Mortars	Air Dispensed Munitions
Recoilless Rifles	Mines, Demolition, Grenades
Automatic Cannon	Flame, Smoke, Incendiary
Artillery, SP and Towed	Pyrotechnics
Combat Vehicle Primary	Missile/Rocket Warhead
and Secondary Armament	Sections

Systems and materiel include fire control, fuzes, and conventional, nuclear, and chemical ammunition as applicable.

4. Organization. The center is built upon a core of four laboratories (Figure 1-1)

Large Caliber Weapon Systems Laboratory
Small Caliber Weapon Systems Laboratory
Chemical Systems Laboratory
Ballistics Research Laboratory

a. The output of the laboratories' activities in the technology base (basic and applied research) will be prototypes of conceptual components and subsystems, as well as simulation and modelling. Prototypes that gain DA approval for full-scale development will progress within a laboratory through the development phase and into initial production. The same engineering and management team will be responsible for a project throughout the cycle.

b. Several new aspects of the ADC concept of operations are the Armament Concept Office, the Systems Evaluation Office and the Plans Office.

(1) The Armament Concepts Office (ACO), a small staff of civilian and military personnel, will collect, develop, evaluate, and exploit ideas and concepts which could provide significant improvements to existing systems or form the basis for entirely new systems. A new concept, that is, one to be tested by the user in prototype form to establish its military worth and cost, will be managed through the Armament Concepts Office by a small team; members will be drawn from the laboratories and will include a "marketer." The team will exercise control of funds and will provide an important link with both the user and the resource allocator.

(2) The Systems Evaluation Office, a "Red Team" will include

senior civilian and military personnel with combined backgrounds in science, engineering, tactics and doctrine. They will be supported by a resident foreign intelligence element and individuals with systems and cost analysis skills to provide independent assessments. The output of the SEO is the definition of needs and opportunities, independent assessment, and foreign science and technical intelligence service to the center. SEO members are not to be advocates of any particular hardware project, but are to identify opportunities for evolutionary improvement of fielded systems and, when necessary, the need for entirely new systems.

(3) The Plans Office (PO) will provide staff assistance for ADC corporate planning. In conjunction with the major operating elements, the PO will assist management in developing ADC goals and objectives and in assessing the effectiveness and efficiency of the organization, structure, and operations throughout the center. One of the early tasks of the Plans Office will be to determine a measure of output so that a meaningful return on investment can be calculated.

5. ADC Manning. The population of the ADC was derived as follows:

a. First, personnel in the current organization were matched with the missions and functions of the ADC; this established the population of Alternative 1 (Status Quo), a baseline.

b. Second, a "consolidated" population level for a one-site ADC was generated taking advantage of the economies of consolidation, by eliminating redundancies and inefficiencies, and by not building into the ADC those capabilities for which there is a good base in other government activities or in industry.

c. Third, a "minimum" population level was established for a one-site ADC, whereby the ADC would remain a "smart buyer;" at this level the maximum amount of work would be placed out-of-house, either with other government agencies or on contract. The "minimum" level was determined in anticipation that the desired goals in recruitment might not be met. If armament development programs remain at present levels, this minimum population should not be reduced.

d. Finally, both the "consolidated" and "minimum" levels for a one-site ADC were adjusted to meet the slightly increased population needs of two and three-site ADCs.

e. The difference in personnel strength between the "consolidated" and "minimum" population models does not translate into savings; as the ADC population drops, more work would be done by other government activities or on contract rather than in-house.

6. Site Consideration. An all-source survey of available real estate and facilities produced a list of 94 candidate locations for the ADC. Selective criteria and careful screening applied to these candidates narrowed the list to those most suitable for a single-site and those that would best conform to a multi-site ADC. A brief description of each final candidate location listed below is shown in Figure 1-8.

<u>Single-Site</u>	<u>Multi-Site</u>
Fort Irwin, California	Aberdeen, Maryland
Aberdeen, Maryland	Picatinny, New Jersey
Picatinny, New Jersey	Philadelphia, Pennsylvania
	Rock Island, Illinois

7. Figure 1-9 shows the alternatives, distribution of laboratories, and population figures used in the analysis, evaluation, and comparison of alternatives.

ADC CANDIDATE SITES - CHARACTERISTICS

	ACREAGE	GUN FIRING	MAJOR FACILITIES	OTHER
RIA	900	<ul style="list-style-type: none"> • BUTT FIRING • SMALL ARMS 	<ul style="list-style-type: none"> • WEAPONS MANUFACTURE • SIMULATION FACILITY 	<ul style="list-style-type: none"> • ARMCOM HQ LOCATION
PA	6,000	<ul style="list-style-type: none"> • BUTT FIRING • RAIL FIRING • 3,000 METERS 	<ul style="list-style-type: none"> • EXPLOSIVE & PROPELLANT MANUFACTURE • AMMO PILOT PROD 	<ul style="list-style-type: none"> • ADEQUATE BUILDINGS & FACILITIES
PHILADELPHIA	150		<ul style="list-style-type: none"> • TO BE CONSTRUCTED 	<ul style="list-style-type: none"> • NEW FACILITIES OFFERED BY CITY OF PHILADELPHIA
APG	40,000+	<ul style="list-style-type: none"> • 16 KM OVER LAND • 27 KM OVER WATER • MOVING TANK TGTS 	<ul style="list-style-type: none"> • WIND TUNNELS • ENCLOSED FREE FLIGHT RANGE 	<ul style="list-style-type: none"> • ATTRACTIVE BUILDINGS & FACILITIES • WITH TECOM, AMSAA, HEL
FT IRWIN	600,000	<ul style="list-style-type: none"> • UNLIMITED • MOVING TANK TGTS 		<ul style="list-style-type: none"> • IDEAL TEST ENVIRONMENT • BASE SUPPORT FACILITIES

Figure 1-8

ADC ORGANIZATION, SITE, AND POPULATION ^{a/} ALTERNATIVES

CONFIGURATION	ALTERNATIVE	HD LOCATION	NEW SITE	ABERDEEN PROVING GROUND	PICATINNY ARSENAL	ROCK ISLAND ARSENAL	FRANKFORD ARSENAL	WATERVLIET ARSENAL	POPULATION TOTAL
BASE	(1)			BALLISTICS RESEARCH CHEMICAL SYSTEMS 2,797	MUNITIONS PROPELLANTS EXPLOSIVES FUZES 4,154	SMALL ARMS WEAPONS LARGE CALIBER WEAPONS 1,383	FIRE CONTROL SMALL ARMS AMMUNITION SHELL METAL PARTS FUZES 1,625	CANNON AND BREECHES MORTARS RECOILLESS RIFLES 583	10,542
ONE - SITE	(2)	FT IRWIN	4,994 LARGE CALIBER SYSTEMS SMALL CALIBER SYSTEMS BALLISTICS RESEARCH	1,392 CHEMICAL SYSTEMS					6,386
	(3)	APG		6,386 LARGE CALIBER SYSTEMS SMALL CALIBER SYSTEMS BALLISTICS RESEARCH CHEMICAL SYSTEMS					6,386
	(3a)	PA		1,392 CHEMICAL SYSTEMS	4,994 LARGE CALIBER SYSTEMS SMALL CALIBER SYSTEMS BALLISTICS RESEARCH				6,386
TWO - SITE	(4)	APG		3,585 SMALL CALIBER SYSTEMS BALLISTICS RESEARCH CHEMICAL SYSTEMS	3,363 LARGE CALIBER SYSTEMS				6,948
	(5)	APG		4,081	4,002				8,083
	(5a)	PA		BALLISTICS RESEARCH CHEMICAL SYSTEMS 2,402	LARGE CALIBER SYSTEMS SMALL CALIBER SYSTEMS 5,415				7,817
	(5b)	APG		LARGE CALIBER SYSTEMS SMALL CALIBER SYSTEMS BALLISTICS RESEARCH CHEMICAL SYSTEMS 4,632	LARGE CALIBER MUNITION SUBSYSTEMS SMALL CALIBER MUNITION SUBSYSTEMS 3,364				7,996
THREE - SITE	(6)	RIA		BALLISTICS RESEARCH CHEMICAL SYSTEMS 2,402	LARGE CALIBER SYSTEMS 4,002	SMALL CALIBER SYSTEMS 1,887			8,291
	(7)	PA		BALLISTICS RESEARCH CHEMICAL SYSTEMS 2,402	LARGE CALIBER SYSTEMS 4,256		7-NEW FA SMALL CALIBER SYSTEMS 8-OLD FA 1,633		8,291
	(8)	PA							

^{a/} FIGURES AT TOP OF BLOCK ARE FOR 6400 MODEL; BOTTOM FOR 7500 MODEL. Figure 1-9

SECTION C: Analysis, Evaluation, and Comparison of Alternatives.

Alternatives have been compared and evaluated with respect to personnel actions, costs, operational considerations, and community impact. In general, one-site alternatives provide the management focus and internal flow of information inherent in collocation, require investments for new facilities or acceptance of some less desirable although adequate existing facilities, and generate more movement and recruitment of personnel than multiple site options. Two-site options are the middle ground where management focus and technology coupling among laboratory elements are somewhat less intense, but where, in general, cost and personnel actions are reduced. Three-site alternatives require about the same number of personnel movements, but tend to perpetuate many of the conditions which produced the current problems at a cost slightly higher than the two-site alternatives. Among the alternatives none stood out as clearly the best choice, and none was without its disadvantages; however, the two-site alternatives appear to provide the best balance between cost, personnel dislocations and operational effectiveness.

1. Personnel Actions. Establishment of the ADC will have major impacts on personnel resulting from geographical moves required to consolidate, reducing the development population from 10,500 to a level in the range 6400 to 8200, and withdrawing the development community from ARMCOM. Figure 1-10 provides a summary of personnel distribution and personnel actions in terms of transfers in place, transfers by relocating, new recruitment, and separations and reductions in force. A companion to higher retention rates in most two and three-site alternatives is inheritance of the existing population and the corresponding loss of flexibility in staffing the new ADC. Historically, younger employees are forced out in large reductions in workforce. This contrasts with the several AMARC findings that support infusing new blood, new ideas and new attitudes to assist in eliminating the old way of doing business. On the other hand, the effect of lower retention rates is the possible loss of expertise and the difficulty in hiring skilled engineers and scientists in the vacant positions. The Fort Irwin alternative requires approximately 3300 (51%) new hires. The requirements for recruitment of new faces for all other one, two and three-site alternatives range from approximately 165 (3%) to 900 (14%) personnel, the remainder being drawn from the current workforce.

2. Cost Analysis and Benefits.

a. Costs have been analyzed in terms of total investment costs, steady state operating costs, steady state savings, and present value of 15-year total costs. Figure 1-11 contains the results of the analysis of all alternatives and presents the investment recovery period.

PERSONNEL DISTRIBUTION AND ACTIONS

		A L T E R N A T I V E								
1	2	3	3A	4	5	5A	5B	6	7	8
Status Quo	Ft Irwin	APG	PA	APG/PA (Low)	APG/PA (High)	APG/PA	APG/PA	APG/RIA/PA (HQ RIA)	APG/FA/PA (HQ PA)	APG/FA/PA (HQ PA)
PERSONNEL DISTRIBUTION										
Current Base Line (People)	10542	10542	10542	10542	10542	10542	10542	10542	10542	10542
Proposed ADC (Spaces)	10542	6386	6386	6386	6948	8083	7817	7996	8291	8291
Reduction	-	4156	4156	4156	3594	2459	2725	2546	2251	2251
BASE LINE PERSONNEL ACTIONS										
Transfer to ADC	10542	3114	5488	6221	6528	7184	6945	7365	7741	7741
Place OGA: Local	-	1672	1137	973	903	756	810	715	631	631
Relocate	-	1114	758	648	602	503	539	476	420	420
Attrition	-	1392	632	540	504	420	449	397	350	350
Retire	-	1392	632	540	502	420	450	398	349	349
Separate RIF	-	1858	1895	1620	1505	1259	1349	1191	1051	1051
TOTAL	10542	10542	10542	10542	10542	10542	10542	10542	10542	10542
ADC PERSONNEL ACTIONS										
Transfer (In-Place)	10542	1392	2383	4597	4279	4977	5571	5158	5419	5419
Transfer (Relocate)	-	1722	3105	1624	2249	2207	1374	2207	2322	2322
New Recruitment	-	3272	898	165	420	899	872	631	550	550
TOTAL (ADC Population)	10542	6386	6386	6386	6948	8083	7817	7996	8291	8291

Figure 1-10

SUMMARY COST ANALYSES OF ADC ALTERNATIVES

	STATUS QUO	ONE-SITE ALTERNATIVES				TWO-SITE ALTERNATIVES				THREE-SITE ALTERNATIVES		
		1	2	3	3A	4	5	5A	5B	6	7	8
TOTAL INVESTMENT (\$M)	-		286.6	138.0	77.7	74.6	79.3	76.5	78.5	87.1	73.5	72.3
MCA	(-)		(223.5)	(91.0)	(45.4)	(39.6)	(45.0)	(46.9)	(45.6)	(54.4)	(41.2)	(40.0)
OTHER	(-)		(63.1)	(47.0)	(32.3)	(35.0)	(34.3)	(29.6)	(32.9)	(32.7)	(32.3)	(32.3)
STEADY STATE OPERATING COST (\$M)	347.0		271.8	280.8	275.4	293.0	297.9	287.4	296.4	297.3	302.0	302.5
IMPLEMENTATION TIME (YRS)	-		8	5	5	5	4	4	4	4	4	4
STEADY STATE SAVINGS (\$M)	-		75.2	66.2	71.6	54.0	49.1	59.6	50.6	49.7	45.0	44.5
INVESTMENT RECOVERY PERIOD (YRS)	-		10.9	5.0	3.6	4.3	4.6	4.3	4.6	4.6	4.7	4.8
PRESENT VALUE COST (\$M)	2,769		2,678	2,505	2,423	2,528	2,560	2,501	2,552	2,556	2,581	2,584

Figure 1-11

b. The assessment and comparison of the relative benefits of the various alternatives was one of the most important and difficult aspects of the study. Benefits were identified and evaluated in several ways. Committee members, field representatives, and outside consultants all contributed their views. In addition, an analysis was conducted using the Delphi Technique, in which some 40 experts, working individually and anonymously, assigned values to benefit descriptions for five representative alternatives. The results of these various approaches were consolidated in the committee's ultimate assessment.

c. Major elements contributing to the overall cost and benefit analysis are discussed elsewhere in this section.

3. Operational Considerations.

a. Internal Interfaces.

(1) The ADC top management should be located with the bulk of the systems development activities. The systems approach is basic to organization of the three hardware development laboratories. Most of the required expertise in supporting technologies is provided within each of the three materiel development laboratories, but all will receive ballistics technology from the Ballistic Research Laboratory (BRL) and explosives and propellant technology support from the Large Caliber Weapon System Laboratory. The alternatives vary in the degree in which they geographically assist or hinder the coupling of ballistics and explosives with development, but each systems laboratory's elements are collocated in all alternatives except Alternative 5B.

(2) There should be a constant flow of technical information between the Small Caliber and Large Caliber Weapon Systems Laboratories in the areas of fire control, fuzes, munitions, and other common technologies. Some alternatives facilitate this interchange through collocation of laboratories which permits housing common disciplines together.

(3) Both technological and developmental experimentation will be more efficient if live firing ranges are readily available. All alternatives include some collocated firing ranges, but the alternatives differ markedly in capability of ranges available.

b. Flexibility of the Workforce. If all personnel in the center working within a specific technology area, such as fire control or munitions, are at a single location rather than dispersed, there is a greater potential for shifting personnel to meet changes in workload, revitalizing an ailing activity, or "cross-fertilizing" the

laboratories. If these personnel are also located with others working in supporting or related disciplines, the flexibility is even greater.

c. External Interfaces. Work with external organizations (ALC, users, other commodity commands, industry) is made easier and more efficient with increasing laboratory collocation. The ALC will have a resident contingent with the development laboratories for integrated logistic support (ILS) planning and will work closely with the ADC on configuration control boards, procurement strategy, and engineering support of follow-on production. The user contacts will be through the combat development element of the TRADOC schools and, to a lesser extent, with the users themselves. The primary ADC customers will be AVSCOM and TACOM who will look to the ADC for weapon systems for aerial and surface vehicles. MICOM will contract with the ADC for rocket and missiles warhead sections. The ADC, in turn, will be contracting for technology and technical assistance from the Harry Diamond Laboratory, Night Vision Laboratory, Target Acquisition and Battlefield Surveillance Laboratory, MICOM RD&E Laboratory, Human Engineering Laboratory, Army Materiel Systems Analysis Activity, and the Army Materiel and Mechanics Research Center.

d. Fresh Start. The ADC must be established in both substance and appearance as more than just a "stirring of the personnel pot" and "rearranging of organizational blocks." Revitalizing the workforce and introducing a new way of doing business will take new leadership; enough new people with fresh attitudes on systems approach and output orientation; and, finally, the nurturing of pride in the new concept. There is no precise number of new people needed; but it is certain some are essential, especially key leaders. The climate for a fresh start can be affected by the decision to build a new development activity rather than to add on to an existing development activity, and also by the nature and quality of the facilities provided.

e. An overall evaluation of the four major operational considerations applied to each alternative has been summarized for ease of comparison in Figure 1-12. Adjectival ratings ranging from "poor" to "excellent" have been used.

4. Community Economic Impact Statements. The economic impact on the affected communities is contingent upon the number of personnel affected at each installation and the degree of economic dependence on the installations by the local communities. Preliminary generalized economic impact statements on the five areas affected by the various alternatives of the study have been prepared by the Office of Economic Adjustment, and the Office of the Assistant Secretary of Defense (Installations and Logistics). Brief summaries follow:

SATISFACTION OF OPERATIONAL CONSIDERATIONS BY ALTERNATIVE

CHARACTERISTICS PARKING		INTERNAL INTERFACES	WORKFORCE FLEXIBILITY	EXTERNAL INTERFACES	"FRESH START"
EXCELLENT +		(3)	(3)	(3)	(2)
EXCELLENT		(2) (3A)	(2) (3A)	(2) (3A)	(3)
EXCELLENT -			(5A)	(5A) (5B)	
GOOD +		(5A)	(5B)	(4,5)	(4,5)
GOOD			(4,5)		(3A) (5B)
GOOD -		(4,5)			(5A)
FAIR +		(5B)		(6)	(7)
FAIR		(6) (7,8)	(6) (7,8)	(7,8)	(6) (8)
POOR		(1)	(1)	(1)	(1)

◀ KEY TO ALTERNATIVES^{a/} ▶

BASE	(1)
ONE-SITE	(2) Fort Irwin (3) APG (3A) PA
TWO-SITE	(4) APG (Small Cal Sys, Ballistics) - PA (Large Cal Sys) (5) APG " PA " (5A) APG (Ballistics) - PA (Large & Small Cal Sys), (5B) APG (Large & Small Cal Sys, Ballistics) - PA (Large & Small Cal Munition Subsys)
THREE-SITE	(6) APG (Ballistics) - PA (Large Cal Sys) - RIA (Small Cal Sys) (7) APG " - PA " - FA (New) " (8) APG " - PA " - FA (Old) "

^{a/} Chemical Systems Laboratory remains in place at APG (Edgewood).

a. Picatinny Arsenal - The local community at this site is currently in an economic slump, precipitated to some degree by past DoD actions at the arsenal. Unemployment is significantly higher than the national average. Further reductions would aggravate this situation; however, the impact could be lessened by phasing down over a period of time, and accelerating retirements of those who are currently eligible.

b. Frankford Arsenal - The metropolitan Philadelphia area is one of the major industrial centers of the United States. However, its economic activity is shifting away from manufacturing; and the city has a low median income and relatively high unemployment. The potential loss to the community could be moderately significant, depending on possible reuse of the site and facilities by private industry.

c. Aberdeen Proving Ground - The economic health of the local community is reasonably good; however, the total impact of this action should be considered in light of other potential DoD actions. The immediate vicinity is characterized as being overly dependent upon a military-based civilian population which could suffer a moderate disruption. This action could be offset by the expansion of the Baltimore-Washington development corridor.

d. Watervliet Arsenal - The local economy is both highly industrialized and relatively strong, with unemployment somewhat below average. The economic base is diverse and, as such, is able to absorb potential reductions. Hence, the impact of the action on the total area is not expected to be significant.

e. Rock Island Arsenal - The local economy is currently strong, characterized by low unemployment and continued economic growth. Manufacturing is predominant in the immediate vicinity and could partially absorb any reductions. Thus, the total impact is considered to be minimal.

6. Overall Comparison of Alternatives. For the overall comparison, alternatives are grouped in terms of one-site, two-site and three-site, and evaluated to arrive at the selection of preferred alternatives. A brief explanation of the criteria is also provided. The entire analysis is summarized in Figure 1-13.

A. Comparison of One-Site Alternatives (2, 3, and 3A).

(1) Although Fort Irwin Alternative 2 would offer the best of the "fresh starts," it is not recommended because of the high investment cost, the very high personnel turbulence, the great risk of loss of armament development capability, the difficulty in

COMPARISON OF ALTERNATIVES

CONFIGURATION	ALTERNATIVE ^{a/} LOCATION ^{b/} POPULATION ^{c/}	OPERATIONAL CONSIDERATIONS					PERSONNEL ASPECTS				COSTS			^{f/} COMMUNITY ECONOMIC IMPACT
		INTERNAL ^{d/} INTERFACES	WORK FORCE FLEXIBILITY	EXTERNAL INTERFACES	"FRESH START"	STEADY STATE DATE (FY)	TRANSFERS (% OF ADC)		RECRUITMENT REQUIRED (% OF ADC)	SEPARATION (RIF) EXPECTED	ONE TIME INVESTMENT (MILLIONS)	ANNUAL STEADY STATE (MILLIONS)	PRESENT VALUE 15 YEAR OPERATIONS (BILLIONS)	
BASE	① RIA, FA, PA APG, WA 10,542	POOR	POOR	POOR			100%					\$347	\$2.77	
	② FT IRWIN 6,386	EXCEL	EXCEL	EXCEL	EXCEL+	1984	1392 (22%)	1722 (27%)	3,272 (51%)	1,858	\$287	\$272	\$2.68	VERY SEVERE
	③ APG 6,386	EXCEL+	EXCEL+	EXCEL+	EXCEL	1981	2383 (37%)	3105 (49%)	898 (14%)	1,895	\$138	\$281	\$2.50	SEVERE
ONE- SITE (LOW POP)	③A PA 6,386	EXCEL	EXCEL	EXCEL	GOOD	1981	4597 (72%)	1624 (25%)	165 (3%)	1,620	\$ 78	\$275	\$2.42	MODERATELY LARGE
	④ APG, PA 6,948	GOOD-	GOOD	GOOD+	GOOD+	1981	4279 (62%)	2249 (32%)	420 (6%)	1,505	\$ 75	\$293	\$2.53	MODERATE
	⑤ APG, PA 8,083	GOOD-	GOOD	GOOD+	GOOD+	1980	4977 (62%)	2207 (27%)	899 (11%)	1,259	\$ 79	\$298	\$2.56	MODERATE
TWO- SITE (HIGH POP)	⑤A APG, PA 7,817	GOOD+	EXCEL-	EXCEL-	GOOD-	1980	5571 (71%)	1374 (18%)	872 (11%)	1,349	\$ 76	\$287	\$2.50	MODERATE
	⑤B APG, PA 7,996	FAIR+	GOOD+	EXCEL-	GOOD	1990	5158 (64%)	2207 (28%)	631 (8%)	1,191	\$ 79	\$296	\$2.55	MODERATE
	⑥ APG, PA, RIA 8,291	FAIR	FAIR	FAIR +	FAIR	1980	5375 (65%)	2378 (29%)	538 (6%)	1,045	\$ 87	\$297	\$2.56	MODERATE
THREE- SITE (HIGH POP)	⑦ APG, PA, NEW FA 8,291	FAIR	FAIR	FAIR	FAIR+	1980	5419 (65%)	2322 (28%)	550 (7%)	1,051	\$ 74	\$302	\$2.58	SLIGHT
	⑧ APG, PA, OLD FA 8,291	FAIR	FAIR	FAIR	FAIR	1980	5419 (65%)	2322 (28%)	550 (7%)	1,051	\$ 72	\$302	\$2.58	SLIGHT

^{a/} Alternatives are defined in Figure II-4

^{b/} Edgewood Arsenal CS activity becomes the Chemical Systems Laboratory and remains in place at APG in all alternatives. BRL wind tunnels and ranges are also left in place.

^{c/} Any alternative could be built on the 6,400 or 7,500 man model; for economic analysis purposes, alternative 1 through 4 were built on 6,400 and 5 through 8 on 7,500 models.

^{d/} Internal interfaces - judges combined effects of location of ADC HQ and span of control, coupling technology with development, and integrated systems management.

^{e/} External interfaces - judges ease with which ADC can interact with ALC, user, AMC users and other Services, AMC HQ, private sector, and other AMC laboratories.

^{f/} Community impact summary - quantitative reflection of impact on communities is shown on the next page,

Figure 1-13

a/
COMMUNITY IMPACT SUMMARY

COMMUNITY	ALTERNATIVE										
	CURRENT	2	3	3A	4	5	5A	5B	6	7	3
ROCK ISLAND	7,997	- 110	- 110	- 110	- 110	- 110	- 110	- 110	+1,789	- 110	- 110
PICATINNY	5,735	-5,735	-5,735	+ 553	-1,116	- 477	+ 974	-1157	- 477	- 213	- 213
WATERVLIET	2,801	- 600	- 600	- 600	- 600	- 600	- 600	- 600	- 600	- 600	- 600
FRANKFORD	3,600	-3,600	-3,600	-3,600	-3,600	-3,600	-3,600	-3,600	-3,600	-1,505	-1,505
ABERDEEN	15,148	-1,631	+3,743	-1,631	+ 600	+1,096	- 621	+1,689	- 621	- 621	- 621
FT IRWIN	-	+5,374	-	-	-	-	-	-	-	-	-

a/ Net impact on community due to ADC and ALC implementation.

Figure 1-14

Change page per Errata Sheet #2

maintaining program continuity, and the long delay in initiating and completing establishment of the ADC.

(2) The Aberdeen Alternative 3 is selected as one of the preferred alternatives. It achieves the highest degree of consolidation, collocates all four laboratories with the needed firing ranges, provides an excellent facility for the long term and could be completed by FY81.

(3) The Picatinny Alternative 3A is not recommended even though it consolidates everything except the Chemical Systems Laboratory and the Aberdeen ranges and wind tunnels. The short term advantage of building on an existing large development base becomes a handicap to a fresh start for the long term. The lack of on site, long distance ranges for both the ballistics and weapon systems laboratories is also a disadvantage for a long term, single-site ADC.

B. Comparison of Two-Site Alternatives (4, 5, 5A and 5B).

(1) Alternative 4/5 (6400 and 7500 models). (Large Caliber Weapon Systems Laboratory at Picatinny; everything else at Aberdeen.) Alternative 5 is selected as one of the preferred alternatives because it takes advantage of the explosives, munitions, and fuze skills and the facilities at Picatinny; it provides the small caliber development activity a fresh start at Aberdeen, the advantage of collocation with BRL, and the availability of long distance ranges: it makes use of the best facilities at both Picatinny and BRL; and it can be implemented rapidly.

(2) Alternative 5A. (ADC Headquarters, Large and Small Caliber Weapon Systems Laboratories at Picatinny; Ballistics and Chemical Systems Laboratories at Aberdeen.) Alternative 5A is selected as a preferred alternative because it collocates top management and the two weapon systems laboratories (approximately 70 percent of the population), provides for excellent flexibility of the workforce, facilitates technology interchange between the Large and Small Caliber Weapon Systems Laboratories and coupling with the explosives technology base, is the lowest cost two-site alternative, and can be implemented rapidly.

(3) Alternative 5B (ADC Headquarters and all laboratory headquarters at Aberdeen; munitions and fuze portions of Large and Small Caliber Weapon Systems Laboratories at Picatinny.) Alternative 5B is not carried forward for further consideration because it is not believed the advantages of collocating all the laboratories' headquarters with the ADC Headquarters, good workforce flexibility, and close technology coupling offset the disadvantage of separating munitions work from weapons development.

C. Comparison of Three-Site Alternatives. These alternatives all place the Large Caliber Weapon Systems Laboratory at Picatinny and the Ballistics and Chemical Systems Laboratories at Aberdeen. The primary variation in these alternatives is the location of the Small Caliber Weapon Systems Laboratory at Rock Island in Alternative 6, at the site proposed by Philadelphia ("new" Frankford) in Alternative 7, and at "old" Frankford in Alternative 8. Alternative 6 (Rock Island) is slightly less costly than 7 or 8; The ADC Headquarters would be closer to the ALC Headquarters, but more distant from the mass of the ADC activity at Aberdeen and Picatinny. The three-site alternatives do offer slightly higher retention of current skills, fewer separations, and more diffused economic impact on communities than two-site alternatives; but they combine the disadvantages of two-site alternatives 5 and 5A without any compensating operational benefits or cost advantage. Management becomes complicated, the flexibility of the workforce is reduced, and technology interchange is inhibited. Accordingly, the three-site alternatives will not be considered further for recommendation as preferred ADC alternatives.

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This four-volume study responds to a DA requirement to study the recommendation of the Army Materiel Acquisition Review Committee (AMARC) regarding establishment of an Armament Development Center. The study concludes that such an organization should be created and proposes several feasible options. These are conceptual in nature; they are not detailed plans. Included is a substudy examining in concept the impact on the remainder of the Army's armament community.		